

Diagnosis of the Basic Sanitation of the Prata Lagoon and Maresia Lagoon, Prosai-Maués Project, Located in the Municipality of Maués - Amazonas

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Abstract

The discussion about the quality of Environmental Sanitation (ES) services is currently highlighted because it is directly linked to the population's quality of life. Assessing the scope of SA services has become an important tool for the management of municipalities and states, as it allows the adaptation to the reality of the population to improve future planning, foreseeing the expansion of SA services. The Municipal Basic Sanitation Plan - PMSB was established by Law No. 11.455 / 2007 as an important planning tool for basic sanitation services. It consists of programs, projects and actions aimed at improving the conditions of services that constitute basic sanitation: water supply, sanitation, as well as urban solid waste management and urban river water. With the accelerated urban growth in the municipality of Maués and the intense aggressions to the environment, the PROSAI-MAUÉS ES indicators were identified and diagnosed, which propose improvements in the urban, environmental and basic sanitation conditions of the municipality with the recovery of Lagoas do Silver and Maresia, which for many years have suffered from pollution around the lagoons. The lagoons in question were chosen for the implementation of PROSAI-MAUÉS, explained by the occupation of its margins by low-income population installed on stilts, the existence of flood risk points and the need for renewal of this urban fragment of tourist importance. On-site research was conducted using observation techniques and photographic recording to describe the conditions of local sanitation services. The experience of the PROSAI-MAUÉS project indicates that it is

necessary to seek the institutional strengthening of the entities involved with the local society since the early stages. from the initial planning and execution to the final phase of monitoring and follow-up of the services provided by the basic sanitation works, thus ensuring the sustainability of the Program for future generations.

Keywords: Water Supply; Depletion; Urban Drainage.

1. Introduction

The problems in the urban environment are caused by the expansion of the territorial occupation of cities, because the infrastructure offered is not always able to serve the population with sanitation services, especially in water supply, treatment, sanitation and sanitation management. municipal solid waste.

The absence of sanitation services results from factors such as poor conditioning of urban solid waste, the deficiency of water supply service, the inefficiency of the sewage collection and treatment network, causing problems to the health and quality of life of the population. , added to the difficulty of the Government to manage these aspects.

The discussion about the quality of Environmental Sanitation (SA) services is currently highlighted because it is directly linked to the population's quality of life. Assessing the scope of SA services has become an important tool for the management of municipalities and states, as it allows the adaptation to the reality of the population to improve future planning, foreseeing the expansion of SA services.

According to [1], only 68% of the world's population has access to adequate sanitation and more than two million people worldwide live without adequate sanitation.

As stated, [2], the acceleration of population growth does not go along with economic and social progress due to political and management issues, one of the negative consequences being the absence, insufficiency or inefficiency of water supply, sewage, drainage and garbage collection, which directly affects the society that inhabits or uses it.

According to [3], public policies can be defined as all government actions that favor the public interest. Brazil suffers from the absence of public policies, so there are interferences in the management of sanitation services, as the problems intensify aggravating public health, which directly interferes with the population's quality of life.

For any country, the efficiency, quality and universality of basic sanitation services are fundamental to the quality of life of the population. This sector has direct impacts on a country's public health, environment and economic development [4].

In Brazil, public basic sanitation services are a right guaranteed by the Federal Constitution and defined by [5] and has as one of its principles the universalization of basic sanitation services, so that everyone has access to them. However, there is a large proportion of Brazilian citizens who do not enjoy these services. The Municipal Basic Sanitation Plan - PMSB was established by Law [5] as an important planning tool for basic sanitation services. It is comprised of programs, projects and actions aimed at improving the conditions of services that constitute basic sanitation: water supply, sanitation, as well as urban solid waste management and urban river water [6].

According to [7], environmental health is the state of health in which the urban and rural population lives,

in terms of their ability to inhibit, prevent or prevent the occurrence of endemics or epidemics transmitted by the environment, As for its potential for promotion, the improvement of mesological conditions favorable to the full enjoyment of health and well-being.

Also, according to [7]: environmental sanitation is the set of socioeconomic actions that aims to achieve Environmental Health through drinking water supply, collection and correct disposal of solid, liquid and gaseous waste, urban drainage, control communicable diseases and other specialized services and works. Ensuring quality and universal access to basic sanitation in Brazil is still a major challenge. Like other essential public services, deficits denounce the country's delay in guaranteeing basic rights such as access to water and the safe disposal of waste and solid waste. Exclusion and inequality and the low quality of services is the product of a development model linked to the capitalist mode of production and as such a promoter of contradictions, antagonism and inequities [8].

The City Hall of Maués held, on March 25, 2018, the solemnity event that marks the resumption of the works of the Maués Integral Sanitation Program (PROSAI MAUÉS), 267 km away from Manaus. The project aimed to restore the Lagoon do Prata and Lagoon do Maresia, with urban upgrading, water supply, sewage and urbanization, squares, fairs, exhibitions and bicycle paths [9].

It is a project financed by the Inter-American Development Bank (IDB) in the amount of US \$ 35 million, with US \$ 10.5 million in counterpart funding from the Amazonas State Government (GEAM). The works of PROSAI MAUÉS had been stopped since 2013 and only in 2018 were they resumed by the political articulation of Maués municipal public administration with GEAM [9].

With the accelerated urban growth in the municipality of Maués and the intense aggressions to the environment, the PROSAI MAUÉS SA indicators were identified and diagnosed, which propose improvements in the urbanistic, environmental and basic sanitation conditions of the municipality with the recovery of the Silver and Maresia lagoons, which for many years have suffered from pollution around the lagoons.

The lagoons in question were chosen for the implementation of PROSAI MAUÉS, explained by the occupation of its banks by low-income population installed on stilts, the existence of flood risk points and the need for renewal of this urban fragment of tourist importance.

The study evaluated the basic sanitation actions based on the [7] Manual for the diagnosis of AS in Lagoon do Prata and Lagoon do Maresia, populous areas with greater environmental impact.

From the elaboration of the diagnosis it was possible to identify the improvement data for the Water Supply (AA), the Sanitary Sewage (ES) and the Urban Drainage (DU) of the PROSAI MAUÉS project, detecting the successes and the improvement points of the management. basic sanitation, making the public aware with transparency and listening to the proposals of society with the objective of solving the detected problems [10].

2. Materials and Method

The research is qualitative, descriptive, in which data will be collected from public documents and other sources of collection [11]. They collected information from the Water Supply (AA), Sanitary Sewage (ES) and Urban Drainage (DU) services in the surroundings of Lagoon do Prata and Lagoon da Maresia,

performing the diagnosis of PROSAI MAUÉS works, in the municipality of Maués - AM .

Then, the field work was carried out, with the on-site research, with the visit around Lagoon do Prata and Lagoon do Maresia, in which observation techniques and photographic record were used to describe the conditions of sanitation services. Basic place. In addition, there were visits to public agencies such as the Municipal Secretariat of Environment, Infrastructure, Health and the SAAE Water Company to collect data on water supply, sewage and urban drainage.

The information was tabulated and compared with the works of PROSAI MAUÉS, and the results are presented in tables and figures, for the demonstration of the quality of environmental sanitation around the lagoons.

2.1 Study area

The study is focused on Maués, one of the 62 municipalities of Amazonas that is 267 km, straight, from the capital Manaus and has about 63,905 thousand inhabitants. Its headquarters is located in a solid ground area with an altitude of 18 m above sea level [12] (Figure 1).

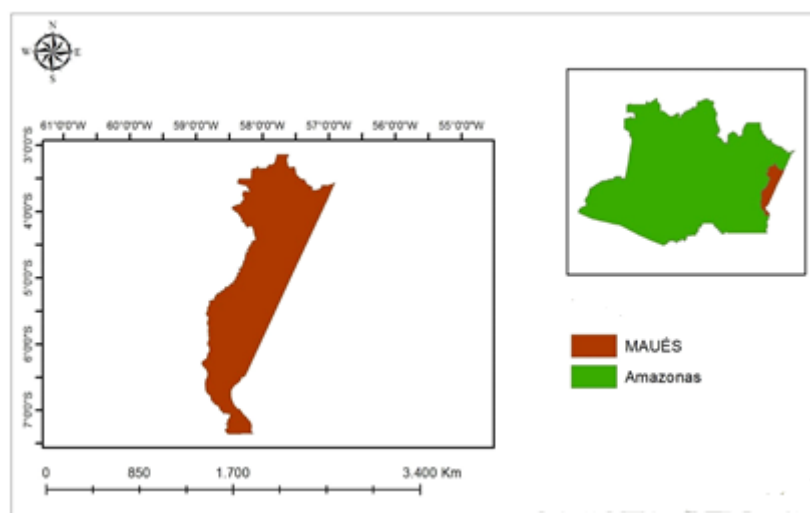


Figure 1 - Location map of the municipality of Maués-AM.

Source: Prepared by the Author Himself (2019).

3. Results and Discussion

The urban works of the Maués Integrated Sanitation Program (Prosai-Maués), the interior version of Prosamim, began at Lagoon da Maresia and Lagoon do Prata, in the central region of the municipality's headquarters. PROSAI MAUÉS worked on two of the five largest lagoons in the municipality that face serious environmental pollution problems [13].

The PROSAI MAUÉS project benefited indigenous communities from Monte Salem, Sagrada Familia, Santa Izabel, Boas Novas and Monte Horebe; with the construction of artesian wells and reservoirs with capacity of 10.000 L, having the operation through solar plates [14].

It was necessary to study the diagnosis of basic sanitation around the works of the two lagoons, related to urban drainage works, water supply, sanitation, environmental mitigations and improvements for the local population, making analysis of the work.

Initially, we highlight the PROSAI MAUÉS work management process, with the project's initial budget in 2013 for 6 years of planning and execution, but it was closed in 2019, contributing to generate solutions for basic sanitation problems. , urban and socio-environmental factors that affect the population's quality of life and the sustainability of the Municipality of Maués (Figure 2).

Loan agreement	Cost			Validity
	BID	GEA	TOTAL	
2846/OC-BR	24.500	10.500	35.000	23/12/2013 A 23/08/19
PARI PASSU	70%	30%	100%	6 ANOS



Figure 2 - PROSAI MAUÉS Program Cost Planning.

Source: AMAZONAS (2019).

It is observed that PROSAI MAUÉS was developed to support the physical, financial, accounting and administrative management, providing planning, monitoring and social control with the participation of regulators and supervisors of the public purse. Demonstrating the US \$ application of program components for environmental and urban improvement; social, economic and institutional sustainability; and drinking water and sanitation for indigenous communities (Figure 3).

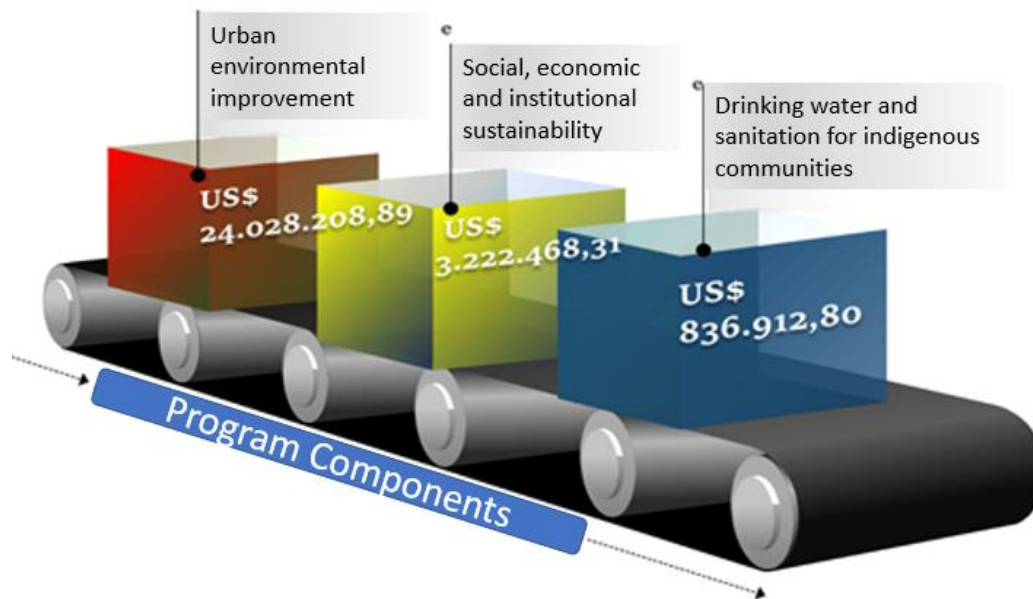


Figure 3 - Investments in US \$ dollars of program components.

Source: AMAZONAS (2019).

In the financial administrative process, on-site audit was monitored by members of the program's financial team, ensuring the release of funds by the IDB for the PROSAI MAUÉS project.

According to Article 3 [5], which establishes national guidelines for basic sanitation, sanitation service sets are defined as follows:

- Drinking water supply: set of activities, infrastructures and facilities necessary for the public supply of drinking water; the capture up to the building connections and their measuring instruments;
- Sanitary sewage: set of activities, infrastructures and operational facilities for proper collection, transportation, treatment and final disposal of sanitary sewage, from building connections to final release into the environment;
- Urban cleaning and solid waste management: set of activities, infrastructures and operational facilities for the collection, transportation, transshipment, treatment and final destination of domestic waste and waste originating from the sweeping and cleaning of public places and roads;
- Urban stormwater drainage and management: set of urban stormwater drainage activities, infrastructures and operational facilities, transport, detention or retention for flood flow damping, treatment and final disposal of drained stormwater in urban areas [5].

At the conclusion of PROSAI MAUÉS works in the surroundings of Lagoon of Prata and Lagoon of Maresia, the services of AA, ES and DU were diagnosed respectively, presenting the solutions and challenges of social and environmental impacts with local residents in urban intervention.

The Maués water supply service is currently carried out by the municipal council called Maués Autonomous Water and Sewerage Service (SAAE), which has been without investments for over a decade. The city's water supply was provided through 9 shallow 33 m wells connected directly to the network, with only a 227 m³ high reservoir that was not sufficient to serve a population of over 30,000 in the absence of electric power.

Another obstacle was waste, which of the 5.4 million m³ captured annually, 66% was wasted by clandestine connections, residential misuse and lack of maintenance. The index quoted exceeds the national average of 41% according to [15].

With PROSAI MAUÉS interventions, 07 new 80 m deep tubular wells were built; 03 supported tanks; 02 elevated reservoirs; construction of 5,340 m of water distribution network; installation of 2,500 meters, enabling the municipality to serve 92% of the urban population with water treated for human consumption. With these investments applied, the municipal administration acted on new fronts with the population to set up a council and a Municipal Basic Sanitation Fund, institutional educational campaigns in the city's education channels and official networks, lectures to the municipal education networks and application of inspections of homes and businesses.

Just as the vast majority of Amazonian municipalities Maués did not have an adequate sewage system, it was through septic tanks and sinks. Sinks were common mainly around the lagoons, causing a major health problem during flooding periods where they were submerged for a long time during the rainy season.

A large part of the population, due to lack of knowledge related to the environment, and especially financial conditions, choose this rudimentary environment causing a great impact on the soil and groundwater. The sanitary sewage system seeks to properly dispose of wastewater, that is, sewage or effluents, ensuring proper treatment before final disposal occurs. Thus, it is intended to minimize and even eliminate the risks related to public health and the environment arising from the inadequate discharge of effluents, complying with legal standards in force [16].

Approximately 18.2 million reais was invested to improve sewage sanitation and wastewater treatment. Through the Special Projects Management Unit (UGPE), 13,842 m of collecting network was recovered and an additional 18,598 m was built, totaling 32,440 m. To meet the need for effluent transshipment, 07 pumping stations were built at strategic points, as well as rebuilt an Effluent Treatment Station (ETE) capable of serving twice the urban population [13].

From septic tanks to sinks today Maués has about 3,433 infra-household connections serving about 52% of the population, positioning it as the city of the interior of Amazonas with the largest sanitary sewage network. In a large project that involves the basic needs of the population such as Basic Sanitation, it is necessary that the UGPM and UGPE continue to work together to increase community adherence to the sewage system implemented and create a maintenance plan, ensuring the good utilization and preservation of the implemented works.

One of the major difficulties in implementing basic sanitation in Amazonas is the topography of municipalities. The municipality of Maués was built without any planning, and over time the problems were appearing, the city's urban drainage has macro and micro drainage.

The main streets of the city have gutters, curbs, wolves, some in bad conditions, without railing, being susceptible to the entry of solid waste in rainy weather. It is also reiterated that the diagnosis of this service should also include the entire planning area of the PMSB, namely: the urban and rural areas of the municipality, including the dispersed areas (quilombola, indigenous and traditional communities) and the areas where the low-income population lives (slums, irregular occupations, precarious settlements, among other denominations), as determined by the City Council [6].

Some parts of the city suffered from flooding of some streets causing inconvenience to residents, but the

problems have already been solved in partnership with UGPM and UGPE. PROSAI MAUÉS 'intervention in terms of Urban Drainage took place around the two lagoons, the macro drainage work was renewed and expanded at the main entrance located in Lagoon do Prata. New wolf mouths, gutters and curb were renovated and built to a total length of 1,597 m.

The surroundings of the Prata and Maresia lakes meet the Master Plan of the Municipality of Maués (2 m wide), where drainage interventions around the lakes met local needs, but it is up to the municipal agencies to expand such needs to the periphery of the region. city suffering from lack of drainage [14].

In the field of drainage, soil occupation, waterproofing levels, the road system, strategies and standards for the protection of permanent preservation areas and for the management of rainwater or flood damping, the protection of recharge areas. among others, were extremely important points for the management of rainwater.

The economic activity of the municipality revolves around the culture of guarana and agriculture, the implementation of PROSAI MAUÉS works may bring positive reflexes in the promotion of tourism, one of the great potentials of economic development of the municipality combined with local sustainability.

PROSAI MAUÉS fulfilled all the requirements imposed by the IDB by conducting environmental studies, complying with conditions, restrictions on environmental licensing, safeguarding of archaeological heritage and the rescue of fauna and flora. It is the responsibility of the Municipal Secretariat of Environment (SEDEMA) to replace native species in the intervention sites.

Over time with the growth of the city irregular occupations became constant around the lakes, requiring interventions to try to restore the environmental quality of the site.

Another dialogue that was essential involved the field of urban planning, an activity foreseen in the Federal Constitution, through the elaboration of Master Plans. The Master Plan is the basic instrument of urban policy and should ensure the social function of the city by addressing citizens' needs for quality of life and social justice.

Technical teams were made aware by families about the benefits of the program and Basic Sanitation. The program implemented 208 resettlement solutions benefiting 1,472 needy families with sewage connections and the construction of 39 toilets (Figure 4).

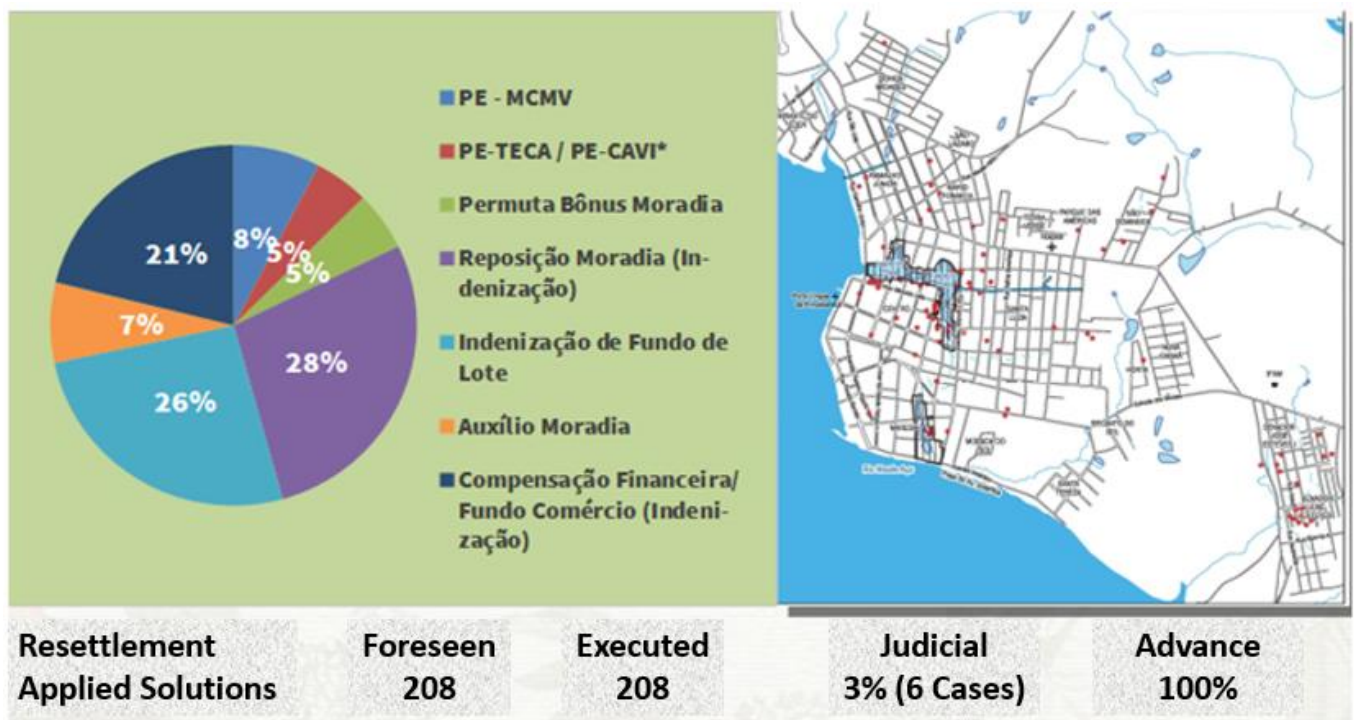


Figure 4 - Resettlement - Housing Replacement and Financial Compensation

Source: AMAZONAS, 2019.

The right to sanitation is one of the guidelines of urban policy, expressed by [17], known as the City Statute. Through the Municipal Master Plan of Maués there was the urban intervention, which assessed the demands throughout the municipality of Maués, including the city sectors, and verified the capacity of sanitary infrastructure in water and sewage installed, in order to identify alternatives to serve the population (Table 1) [18].

Table 1. Diagnosis of the variables analyzed in an urban intervention.

Variables analyzed	Silver Lagoon	Maresia Lagoon
Supply	92% of the population with drinking water	Repair and installation of new plumbing and flow
Burnout	Structure for the collection and treatment of sewage, serving 52% of the urban population	Adequacy of septic tank structures for indigenous communities
Drainage	Micro drainage installation around the lagoon;	Micro drainage installation, with a view to urban mobility of the Master Plan
Cheers	Construction of courts, playground and gym	Reduction of waterborne diseases

Source: Elaborated and adapted [18].

The PROSAI-MAUÉS program has shown the following positive points: The approach for the transfer of works from indigenous communities to the DSEI; the integration between the teams of PREFECTURE / UGPM and STATE / UGPE; the use of the methodology adopted in the review and preparation of studies

focused on urban development through: workshops, seminars and public hearings, which gave rise to specific laws with the community.

On the negative points it was identified that the operational structuring of UGPM / PMM, at the beginning of the execution, was inadequate due to the complexity of the Program; advising / consulting program activities through the advisory committee as provided for in the first phase of the project; the installation of water meters without previous awareness campaign of local users; and the full implementation of the tariff dimensioned in a specific study.

In the social aspect, the population benefited from the resettlement with basic sanitation solutions applicable to families. In Lagoon do Maresia 55 properties were resettled and in Lagoon do Prata 153 properties; benefiting the population with compensation (housing replacement and financial compensation), the land-house exchange, housing assistance and the trade fund.

In the sustainability of the program was implemented the practice of studies designed to increase revenue from City Hall and SAAE; the expansion of operational capacity through training for future operators of the implemented management systems; the creation of the control and inspection committee to ensure the implementation of all plans and actions provided for in the program.

4. Final Considerations

Water supply, sewage and urban drainage systems provide general health benefits to the population. The effects of sanitation interventions are generally positive, as they are a service that ensures the improvement and well-being of the population.

However, investments in sanitation must meet technical, environmental, social and economic requirements in order to work on the concept of sustainable development, preservation and conservation of the environment and particularly of water resources, reflecting directly on the planning of sanitation actions. . Since sanitation services are of local interest and the local government has the competence to organize and provide them, the municipality is the holder of the service. Thus, a sanitation policy should assume that the municipality has autonomy and constitutional competence over the management of sanitation services within its territory, respecting the general conditions established in national legislation on the subject.

The experience of the PROSAI-MAUÉS project indicates that as a lesson learned it is necessary to seek the institutional strengthening of the entities involved with the local society from the initial planning and execution phase to the final monitoring and follow-up phase of the services provided by the sanitation works. thus, ensuring the sustainability of the Program.

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